Smith and Mrs. Bryant is of the moderately conservative type, preserving Euclid's order of propositions, but admitting, especially in Book II., some simplifications of construction and proof. It is not easy to see any definite advantages of this edition over others already in the market; and in some respects it is certainly inferior. The figures are poor; not a few awkward for the pupil to draw, *e.g.* those on pp. 76, 100; and some are grossly inaccurate, such as those on pp. 80, 122. Then, considering the authors' evident desire for strict logic and accurate statement, some of their *obiter dicta* are really surprising. Thus we are told that "the *unequal* side of an isosceles triangle is generally called the base"; that I. 44 is "sometimes enunciated in the form, 'Construct a parallelogram equal to a given parallelogram, and having one of its sides of given length'"; and that I. 17 is equivalent to "If a straight line intersects two other straight lines which meet in a point, the two interior angles which it makes with those straight lines are together less than two right angles." Not to mention the fact that the three lines may be concurrent, the interior angles referred to ought to have been specified.

The bad plan is followed of placing all the definitions, axioms, and postulates at the beginning; a wrong definition of *postulate* is given so as to confine it to postulates of construction, and the postulate required for the theory of parallels appears in its time-honoured, but non-Euclidean place as an axiom. The authors are of opinion that axiom 9 ("magnitudes which can be made to coincide are equal") is Euclid's definition of the equality of geometrical magnitudes, and ought to be put first, and then the other axioms 1—7 can be proved by superposition. In this we feel sure they are mistaken. The real meaning of axiom 9 is that magnitudes which can be made to coincide are *equal* in a sense consistent with the term as used in the preceding axioms; thus, for instance, if a figure A can be made to coincide with a figure B, and if another figure C can be made to coincide with B, then A and C can be made to coincide. That Euclid does not imply the congruence of equal magnitudes is obvious from I. 35, &c. It is true that either of the parallelograms in I. 35 may be cut up into pieces which may be fitted together so as to make up the other parallelogram; but this fact does not appear in Euclid's proof, and it is doubtful whether he was aware of it. And it is clear that "equal" cannot mean simply "congruent," because if congruent figures are taken from congruent figures the remainders are not necessarily congruent.

This brings us to the statement (p. 66), "Whenever there is equality of area" of two figures, "one of the figures can theoretically be divided into parts which, when properly fitted together, will coincide with the other figure." If "parts" means "a finite number of parts," we should like to know the proof of this assertion: it cannot be true in any sense except for figures drawn upon surfaces which are applicable to each other. To take a very simple case, can it be verified for three circles whose diameters are the sides of a right-angled triangle?[1]

In the alternative proof of II. 12, no reason whatever is given for the equality of the rectangles AY, AZ, so that the whole difficulty of this method of proof is shirked by means of a "similarly" applied to dissimilars; the same imperfection occurs in the alternative proof of II. 13.

In I. 24, figures to illustrate the different cases ought surely to have been given; and we should have thought that the direct proof, by superposition, of the first case of I. 26 might have been admitted as an alternative.

Twenty-six abbreviations have been adopted; the definite article is expressed or omitted according to some mystical principle which we have been unable to discover; in some cases the construction and proof are kept separate, and duly labelled in Clarendon type accordingly, in others they are mixed up.

We confess that, on the whole, the perusal of this book has had a depressing effect; it is like reading a treatise on apologetics, and finding that it leaves you more inclined to be sceptical than before. The most serious objection made against text-books of the more modern type is that young boys fail to really grip the essential parts of some of the proofs, and thus, though they understand them at the time, reproduce them in an imperfect and slipshod manner. But here we have two editors of the orthodox text-book, brought up themselves, no doubt, in the true Euclidean faith, and with scores of school editions from which to take warning and example who nevertheless are by no means above reproach, in grammar, logic, or precision of statement.

Erroneous methods of teaching elementary geometry are still so prevalent, and teachers are so apt to rely entirely on their text-book, that every treatise, Euclidean or not, which is intended for beginners, should contain a description of simple instruments and their use, and some hints on the proper way of learning the propositions. Before a teacher sets a proposition to be learnt he should, with a class of beginners, go through it with a blackboard explaining every point, and in particular every technical term when it first occurs; he should insist upon the data of the figure, and these only, being first drawn, and the rest put in as the steps of the construction are stated (this should also be done, at first, by the pupil when learning the proposition); and he should, from the outset, avoid using the same letters as those in the book. This, and the early introduction of very simple exercises, will ensure that the pupil uses his brains and not merely his memory; unless this is the case, the study of geometry is about as improving as it would be to learn by heart a page of the London Directory. G. B. M.

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[1] Unless the arguments of Réthy (*Math. Ann.* xxxviii.) are unsound, this question must be answered in the negative.

OUR BOOK SHELF.

Whittaker's Mechanical Engineer's Pocket-Book. By Philip R. Björling. Pp. 377 + viii. (London: Whittaker and Co., 1898.)

A GOOD pocket-book is a necessity to the engineer; it supplies him with reference tables and constants for facilitating calculations, and also the experience of other engineers in a condensed and handy form for use. One feature of this work is that a rather larger share than usual is given to hydraulics and hydraulic machinery, and also to mining plant. In the formula on p. 3, for the discharge over weirs, a too small coefficient of discharge (apparently 0·45 only) has been adopted; there is also a misprint in the first line of the second column on p. 7, it should be 8·025. In the formula on p. 55, for friction of the leather collars of rams, it is not stated

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in what units the answer is obtained; presumably it is in pounds. The one section which is very disappointing is that devoted to gas engines; only three pages are given to them, and one of these is filled with a useless description of the two original types—the Lenoir and Otto and Langen, both of course interesting in an historical account of the origin of the gas engine, but not of the slightest value or claim to notice in a pocket-book: in future editions it is to be hoped more attention will be given to this section, and that the page mentioned will be cut out. The author would have done well to make use of the recent determination of the mechanical equivalent of heat; most engineers are now adopting 778 as the figure. On p. 93 occurs an awkward misprint in the formula for mean pressure of steam; the letter in the denominator should be R, and not P, as printed. The rules given for the cooling surface of surface condensers, on p. 113, must apply only to single-cylinder engines; at any rate, they give areas greater than usually adopted in the best modern practice for triple compound plants. The sections devoted to pipes and gearing are admirable, and there are many most useful tables; the last fifty or sixty pages contain a valuable collection of tables of weights of various sections of iron and steel, areas of circles, cubes, square roots, &c. We have pointed out a few blemishes, but the book as a whole is very free from slips or errors, and will be, no doubt, of service to many engineers, draughtsmen, and works-managers. H. B.

Handbooks of Practical Science. No. I. *Mensuration, Hydrostatics and Heat.* Pp. 53. No II. *Chemical Experiments.* Pp. 58. By G. H. Wyatt, B.Sc., A.R.C.Sc. (London: Rivingtons, 1897, 1898.)

Science Handbooks for Laboratory and Class Room: Elementary Physics, Practical and Theoretical. First Year's Course. By John G. Kerr, M.A. Pp. 140. (London: Blackie and Son, 1898.)

Quantitative Practical Chemistry. Part I. Elementary Stage. Pp. 55. Part II. Advanced Stage. Pp. 31. By A. H. Mitchell, B.Sc. (Reading: National Publishing Association, Ltd., 1897.)

A NUMBER of simple and instructive experiments are described by Mr. Wyatt in the practical handbooks referred to above. Following sound educational principles the student is told what to do, but so far as it is practicable he is left to find out for himself the conclusions to be drawn from the experiments. In this respect the books are constructed upon the lines of others which are already in use in schools where elementary science is taught. A few practical exercises are given on the principles brought out by the experiments; but the teacher will find it necessary to considerably increase the number of these, if he wishes his pupils to remember what they have done. In his shorthand manuals Sir Isaac Pitman used to advise the students who wished to become proficient in the art of phonography to "Practice, Practice, Practice," and the same advice applies to instruction in elementary science. Not one or two, but twenty or thirty experiments are, for instance, necessary before young students can thoroughly understand the significance of the principle of Archimedes. The difficulty in the way of carrying out so much experimental work is one of time, and if a large amount of work has to be accomplished in a short time, the depth of knowledge is thinner in proportion to the area covered.

In the first of Mr. Wyatt's handbooks, the usual elementary exercises in mensuration, hydrostatics and heat are given; while the second contains simple experiments on general chemical processes, air, combustion, carbon, various common substances, such as salt, lime, &c., acids, alkalis, hydrogen, water, chalk, and important gases. Too much ground is covered in the latter volume for the work to give satisfactory results, but taken as a whole the handbook will be found very serviceable in teaching the rudiments of science.

Mr. Kerr's book on elementary practical physics has much to commend it, and deserves to be widely adopted by pupils commencing the study of physical science. The book contains about a schoolyear's work of three or four hours per week. In the first half a number of experiments to be performed by the pupils individually are described, and in the second half the chapters are more of a descriptive nature, so that they provide material for the pupil to study and wherewith the teacher may exercise him. The principles of measurement, and simple laws of mechanics, form the subjects of the experiments, and the author has introduced many ingenious methods into his work. The pupil who carries out the experiments will be given knowledge which he is not likely to forget. Moreover, as the experiments are mostly quantitative, they offer a valuable course of training for the mind.

Ability to perform simple quantitative experiments is now required by the Department of Science and Art from students of both the elementary and advanced stages of practical chemistry. The object of Mr. Mitchell's slender volumes is to supplement existing text-books by exercises bearing upon the new requirements. Part I. contains experiments on measurement of length, volume, specific gravity and common chemical changes, and Part II. is concerned with the experiments in volumetric analysis so far as they are required of students in the advanced stage.

Researches on Tuberculosis. The Weber-Parkes Prize Essay, 1897. By Arthur Ransome, M.A., M.D. (Cantab), F.R.S., Consulting Physician to the Manchester Hospital for Consumption, &c.

THE book before us is the reprint of an essay written in accordance with certain specific regulations framed by the Royal College of Physicians. This diminishes to some extent the general value of the book, as it almost confines its contents to the individual experience and results of the author. These latter are, however, very extensive, and almost all ground of interest in this subject is to some extent covered. A lengthy chapter is devoted to the natural history of the tubercle bacillus, another to preventive and prophylactic measures; channels and sources of infection are also fully considered. The book concludes with a chapter upon the direct treatment of phthisis. In this connection it may be mentioned that the author seems to have obtained very satisfactory results from the inhalation of ozone. We are pleased that the Royal College of Physicians gave its consent to the publication of this essay, as the book will no doubt be of considerable interest to those engaged in researches upon this subject. F. W. T.

"*The Electrician*" *Electrical Trades' Directory and Handbook for* 1898. (Sixteenth Year). Pp. 918 + cxliii. (London: *The Electrician* Printing and Publishing Co., Ltd., 1898.)

The Universal Electrical Directory (J. A. Berly's). Pp. 1182. (London: H. Alabaster, Gatehouse, and Co., 1898.)

THESE two ponderous volumes give evidence of the remarkable growth of the electrical and allied industries during the past few years. Two large sheets, folded in the first of the volumes at the head of this notice, give particulars of the present electric supply works of the United Kingdom, and the electric railways and tramways. Very few of the supply stations were in existence at the beginning of 1890, and if the progress is as great in the next eight years as it has been in the past eight years, few districts will be without electricity for light, power and traction purposes. The biographical division of the Directory is of more than professional interest, as it contains short sketches of the careers of many

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